LOGARITHMS – John Napier 1614

Exp form $y = b^x$

$b > 0, b \neq 1$

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

Logarithms are inverses of exponential functions.

Logs are used to solve for exponents!

$y = b^x$

$x = b^y$

$y = \log_b x$

Domain: $(0, \infty)$

Range: $(-\infty, \infty)$

$2^3 = 8$

$y = \log(x-3)$

Find domain: Test pls!

$(3, \infty)$

Common Logs

$\log_{10} x = \log x$

Natural Logs

$\log_e x = \ln x$

$\log_{12} 144 = \log_{12} 12^2 = 2$

Make common bases!

$\log_2 16 = \log_2 2^4 = 4$

$\log_9 \frac{1}{81} = \log_9 \frac{1}{9^2} = \log_9 9^{-2}$
$= -2$

$\log_7 \sqrt[5]{7} = \log_7 7^{1/5} = \frac{1}{5}$

$\log_{11} \sqrt[3]{\frac{1}{121}} = \log_{11} \sqrt[3]{\frac{1}{11^2}}$
$= \log_{11} \sqrt[3]{11^{-2}}$
$= \log_{11} 11^{-2/3}$
$= -2/3$

Special Logs

Common logs

$\log_{10} x = \log x$

Natural logs

$\log_e x = \ln x$

$\log 1000 = \log_{10} 10^3$
$= 3$

$\ln \sqrt[7]{e^4} = \ln_e e^{4/7} = \frac{4}{7}$

$8^{\log_8 50} = 50$

$e^{\ln_e 17} = 17$

$y = 2^x$

0	1
1	2
2	4
3	8

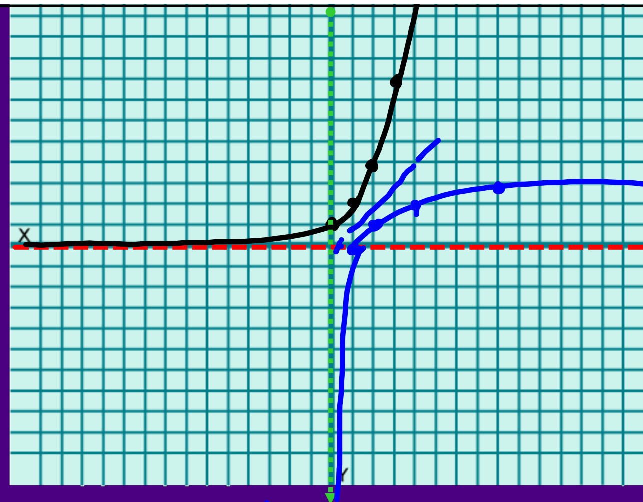
$y = \log_2 x$

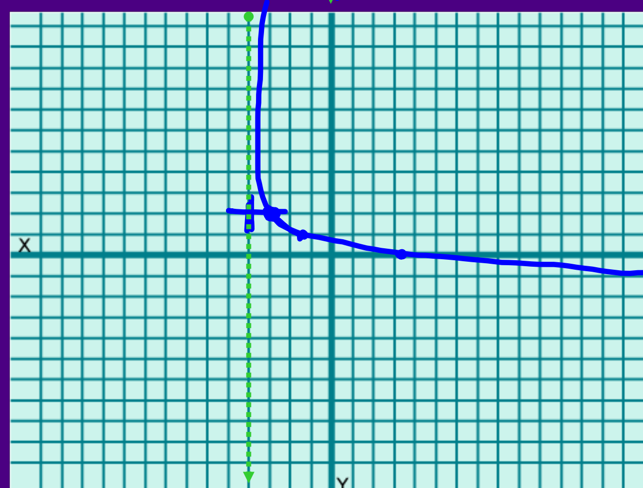
1	0
2	1
4	2
8	3

$y = -\ln_e(x+4) + 2$

left 4   up 2

1	0
2.7	−1
7.4	−2
	3





0

$y = \log_2(-x)$

SOLVING LOG EQUATIONS

Properties

$\log_b m + \log_b n = \log_b (mn)$

$\log_b m - \log_b n = \log_b \left(\frac{m}{n}\right)$

$\log_b m^p = p \cdot \log_b m$

$\log_7 x = 2$

$7^{\log_7 x} = 7^2$

$\boxed{x = 49}$

Check!

$\log_x 64 = 3$

$x^{\log_x 64} = x^3$

$\sqrt[3]{64} = \sqrt[3]{x^3}$

$\boxed{4 = x}$

$$\log(x+3) - \log x = 1$$

$$10^{\log_{10}\left(\frac{x+3}{x}\right)} = 10^{1}$$

$$x \cdot \frac{x+3}{x} = 10 \cdot x$$

$$x+3 = 10x$$

$$3 = 9x$$

$$\frac{1}{3} = \frac{3}{9} = x$$

1) Use properties to reduce each side to one log
2) Exponentiate!
3) Check!